SPECIAL ARTICLES

A REVERSAL OF THE ROWLAND EFFECT

THE result of Rowland's Berlin experiments showed that a wire having a supercharge of negative corpuscles, moved longitudinally in a plus direction, and a wire having less than a normal charge, moved in the opposite direction, would produce the same external field.

In a paper just being issued by the Academy of Science, of St. Louis, the writer shows that when this external field is imposed upon a wire, the corpuscular column within the wire, and the wire itself, are moved in opposite directions.

A copper wire having a diameter of about 0.2 mm. and a length of 55 cm. is placed within a horizontal glass tube of three or four mm. diameter and 50 cm. in length. About 1.5 cm. of the wire at each end is bent at right angles and hangs vertically. Spark knobs on long rods connected with the terminals of an eight plate influence machine, are placed directly over the ends of the tube. A condenser of sheet glass having an area of tin-foil on each side of 1,000 or more sq. cm. is connected with the discharge rods. The spark length was about 4 cm. at each terminal. Sparks passed into the side of the wire at the ends of the tube, at intervals of one to three seconds, depending upon the length of the spark. The machine was driven by a motor. The end of the wire was observed by means of a telescope magnifying about 27 diameters.

No motion of the wire due to a single spark can be observed, but after four or five sparks have passed, one can easily see that it has moved.

The ends of the wire are slightly lifted as the potential rises, and drop when the spark passes. The entire wire is somewhat shaken by the spark, and the effect is to somewhat diminish friction. The interaction between the ends of the wire and the surrounding air is very slight, but it is directed at right angles to the direction in which the wire creeps.

In one case the effect of 3,500 sparks caused the wire to creep over a distance of 1.2 cm.

The paper contains other evidence that such a solid conductor has the properties of the positive column. In one case a ¼ ampere fuse wire in a tube filled with coal oil was fused by a single spark, and became solid again at the instant when it had buckled into a regular series of longitudinal waves. In one case the compression halves of the waves separated into minute spheres, there being about a thousand of them distributed quite uniformly over a half meter of the tube.

No creeping of the wire could be observed, when the ends were dipped into mercury cups and a separately excited dynamo having a terminal potential of 175 volts was momentarily connected with it. Such effects have been observed when high potential discharges wholly outside of the wire have passed between the terminals of the influence machine. These effects have not yet received careful attention. The action of the coherer is of this character.

FRANCIS E. NIPHER

THE PREPARATION OF UNBROKEN POLLEN MOTHER-CELLS AND OTHER CELLS FOR STUDIES IN MITOSIS[1]

SOME recent investigations in the study of pollen mother-cells without the use of the microtome have made it evident that there are certain advantages in preparing and studying unbroken cells for investigation in mitosis. Those in the Bureau of Plant Industry who have examined this method have suggested that a short paper be presented to this society, in order that other workers may try out this method and cooperate in improving its technic. The method seems to be capable of quite wide application in karyokinetic study.

The stamens of a large percentage of our flowers yield the unbroken pollen mother-cells with very little difficulty. Such plants as the grasses, including our grains, supply an abundance of material by simply placing the anthers in a drop of water, cutting the tips with a sharp scalpel and gently tapping them with

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the point of a dissecting needle. The pollen mother-cells float out uninjured. Most other genera are easily treated in the same way. A few genera present difficulties; *e. g.*, the Malvaceæ, where the anthers are so charged with mucilage that the mother-cells can not be handled successfully without considerable trouble.

Before passing to the technic, which is exceedingly simple, I wish to say that the method can readily be adapted to study of the cells of more compact tissues by the simple process of teasing out with needles a few cells and separating them from the rest of the tissue. Although the microtome method is of extreme value to every worker, it has the tendency of tyrannizing over all other methods, some of which are unquestionably better for special purposes.

The killing of the pollen mother-cells can be done either while they are still in the anthers or after their separation. I have found weak Flemming's solution excellent, but Bouin's solution, on the whole, the better for this purpose. It has long been a favorite of the zoologists, but rather neglected by botanists. The formula is:

Picric acid, sat. aq. sol.	75
Acetic acid, glacial	5
Formalin, commercial	20

Fix 4 to 8 hours; wash with 50 per cent. alcohol until no color remains, in which the material may then be kept indefinitely.

After killing and washing, the pollen mother-cells are stained in toto by any satisfactory method. I find that both Heidenhain's iron-hematoxylin and Hermann's modification of Flemming's triple stain are especially good. The latter works vastly better than the regular Flemming stain. The formula is:

Safranin, water soluble	1
Alcohol	10
Anilin water	90

Stain 4 to 8 hours; wash in 50 per cent. alcohol and, if necessary, in acidulated 50 per cent. alcohol. Pass into

Gentian violet	1
Alcohol	10
Anilin water	90

Stain 2 to 6 minutes; wash in water. Pass into Orange G., aq. sol.

I find the concentrated aqueous solution too intense, therefore dilute it with 9 volumes of water. Stain 1 to 3 minutes. Wash quickly in 50 per cent. alcohol and finish with absolute alcohol.

The material is cleared in cedar oil or, where dampness is a drawback to this method, in oil of cloves. There need be no shrinkage whatever in the finished preparation and there can be practically no disturbance in the arrangement of the cell contents.

Pollen mother-cells thus prepared present to the investigator the original packages with unbroken walls, from which no histological particle has escaped. The karyokinetic figures are complete. The chromosomes are all in situ, not sliced up into incomplete ribbons that need to be matched in successive sections, but each one complete and undisturbed. The whole machinery of mitosis, as well as all the adjacent cell contents, make an unbroken unit. The picture under the eye is that of a lot of spheres, transparent, translucent, revealing the contents, with as little chance of artifacts as is possible by human methods.

By mounting such cells in a somewhat limpid medium, such as heavy glycerine or thin Canada balsam and placing a triangular blotting-paper at one side of the cover-glass, the cells may be rolled over under the observer's eye, presenting to view all sides of the karyokinetic spindle and enabling one to count the chromosomes, to notice their position, and to study the entire mechanism with an ease and an absolute certainty that no series of sections can possibly equal.

Three points in this method deserve emphasis:

1. *The comparative ease with which pollen mother-cells can be secured in an unbroken and perfect state,* and prepared for observation as to their internal structure.

2. *The positiveness of interpretation* that can be secured by this method in contrast to

the vexing uncertainties of microtome methods, with which we are all too familiar.

3. *The great saving of time* in arriving at results, because of the elimination of the processes involved in imbedding and sectioning the material.

It may here be stated that a preliminary examination of the pollen mother-cells and of cells secured by needle dissection is greatly aided by the use of a concentrated solution of chloralhydrate, 8 parts of chloralhydrate to 5 of distilled water. This is far better for general use than phenol, eau-de-Javelle and similar clarifying reagents. It will enable the worker to tell at once if the cells under observation are in that particular stage of karyokinesis that it is desired to secure, as the spindles and chromosomes are rendered sufficiently visible to determine the mitotic stage. The regular treatment above described can then be carried out.

The writer would be thankful to hear from any members of the society who, upon investigating the foregoing suggestions, have adverse criticisms to offer or suggestions of improvement to make.[1]

ALBERT MANN
OFFICE OF AGRICULTURAL TECHNOLOGY,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.,
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RESULTS OF PURE CULTURE STUDIES ON PHYLLOSTICTA PIRINA SACC.[1]

IN the summer of 1911 a study of *Phyllosticta* in connection with the frog-eye leaf spot of apples was begun at the Virginia Experiment Station under the direction of Dr. H. S. Reed. Four distinctly different types of *Ph. pirina* were isolated from leaves collected at Blacksburg, Va., by the poured plate method. The different types are possibly elementary species in the De Vriesian sense of the term or pure lines according to Johannsen's use of the term, but will be called strains in this preliminary report.

Microscopically there is much similarity in these strains, except in Nos. 1 and 4 where chlamydospores are produced. The conidia of all four are identical in all characters and the mycelium of only one can be told from the others. The conidia are one-celled, elliptical, hyaline, sometimes with two oil drops. When grown on the same medium no difference in size is noted. On apple leaf agar these spores measure on the average 2.2 × 4.8 microns. The manner of pycnidia and conidia production is the same with all strains.

The macroscopic characters are quite different and any strain may be easily recognized in pure culture. For the sake of convenience these strains have been numbered 1, 2, 3 and 4. So far they have been grown on only three media, viz., apple leaf agar, apple fruit agar and synthetic agar made according to the following formula:

NH_4NO_3	10.0 g.
K_2HPO_4	5.0 g.
$MgSO_3$	2.5 g.
Cane sugar	50.0 g.
Agar agar	20.0 g.
H_2O	1,000 c.c.

Descriptions of test-tube cultures of these four strains of *Ph. pirina* on the three media used and some microscopic features follow:

STRAIN NO. 1

Apple Leaf Agar.—Growth diffuse; mycelium brownish in mass; aerial hyphæ short, snow white, sparse except at top and sides of slant or sometimes in patches on surface of culture; pycnidia small, very dark brown to

[1] Before presenting the above paper I tried to find if a description of this method had been previously published, but could find no trace of it. Since the meeting of the association I find that Professor E. H. Campbell describes a similar process in *Bull. Torrey Bot. Club*, Vol. 17, p. 117. As, however, Professor Campbell's article does not agree in technic with my own, and as it is also evident that this desirable process is not widely used, I think it desirable to publish the paper together with this reference.

[1] Paper No. 17 from Laboratory of Plant Pathology, Virginia Agricultural Experiment Station.